



VCCTL Newsletter

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VCCTL APPLICATION SPOTLIGHT

Reality Check!

Quantitative Comparison of Real and CEMHYD3D
Model Three-Dimensional Microstructures

With all models, a persistent question is: How close is the model to the reality it is trying to simulate? The CEMHYD3D cement hydration model that is part of the VCCTL software is no exception. This issue of the VCCTL newsletter presents a direct comparison of model microstructures to their real world counterparts.

While the two-dimensional microstructure of hydrating cement paste can be easily captured using scanning electron microscopy of polished specimens, the in-situ three-dimensional microstructure is more challenging. However, in September 2000, first-of-their-kind experiments were conducted at the European Synchrotron Radiation Facility (ESRF) in France to do just that. Small 1-mm diameter plastic tubes were filled with cement paste (or Plaster of Paris) and observed using beamline ID 19 at the ESRF. All of the 3-D data sets captured during the week of experiments are now available at a freely accessible web site:

<http://visiblecement.nist.gov>. The data sets were captured with a voxel dimension of $0.95\ \mu\text{m}$, similar to the default voxel dimension of $1\ \mu\text{m}$ employed in the VCCTL system. As shown in the images to the right, a favorable visual comparison between model and real microstructures is obtained, further supported by detailed correlation analysis of the various components present in the 3-D microstructures. A paper on this research has been submitted to Cement and Concrete Research and a preprint is available at <http://ciks.cbt.nist.gov/~bentz/microcompare>

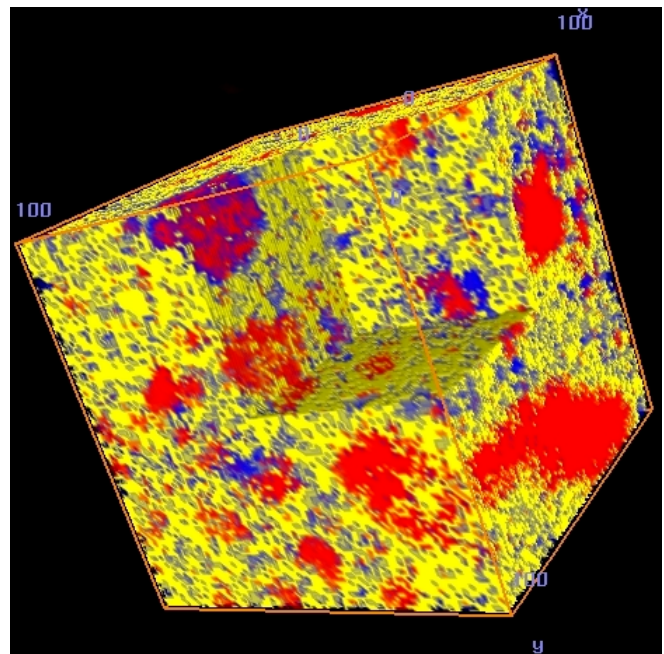
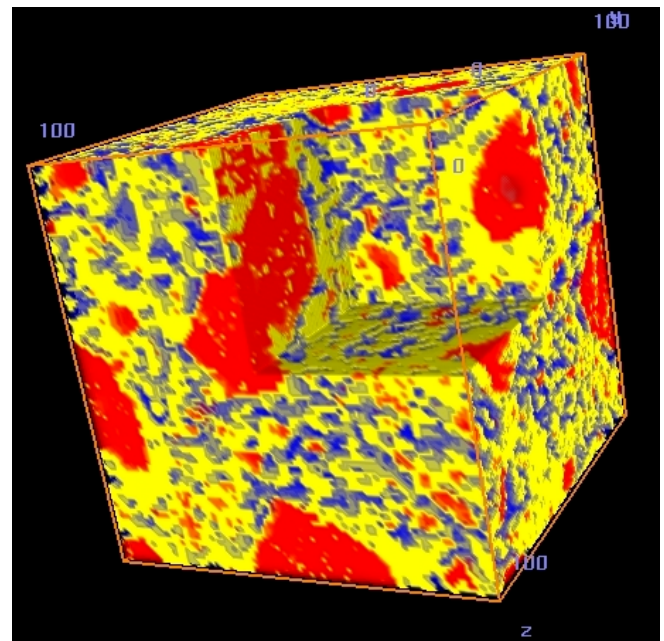
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VCCTL WEB SITES

<http://vcctl.cbt.nist.gov/>
<http://bfrl.nist.gov/862/vcctl/>

VCCTL IMAGE GALLERY



Three-dimensional images ($100\ \mu\text{m} \times 100\ \mu\text{m} \times 100\ \mu\text{m}$) of real (top) and CEMHYD3D (bottom) model microstructures ($w/c=0.47$ and $\alpha=0.62$). Red is unhydrated cement, yellow is hydration products, and blue is water-filled and empty capillary porosity.

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